IDENTIFICATION OF GEOSTRUCTURES OF CONTINENTAL CRUST, PARTICULARLY AS THEY RELATE TO MINERAL RESOURCE EVALUATION

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15 June 1973

Type I Progress Report for Period 1 March 1973 - 31 May 1973

Prepared for:

Goddard Space Flight Center
Greenbelt, Maryland 20771

Publication authorized by the Director, U.S. Geological Survey

7 pp.

Type I Progress Report
ERTS-A

a. Title: Identification of geostructures of continental crust particularly as they relate to mineral-resource evaluation.

ERTS-A Proposal No.: SR 180

b. GSFC ID No. of P.I.: IN 387

c. Statement and explanation of any problems that are impeding the progress of the investigation:

None.

(This report is submitted in lieu of Type I report due on May 1. Both Principal Investigator and Co-Investigator were in travel status from late April through May. Current report therefore covers March, April and May accomplishments. June report will be included in the annual report due July 1, 1973.)

d. Discussion of the accomplishments during the reporting period and those planned for the next reporting period:

This investigation is not funded by NASA; activities are supported by Branch of Alaskan Geology, U.S. Geological Survey and by EROS Program, Dept. of the Interior. Direct results of the investigation as well as activities relating to it are reported here.

1. Accomplishments during the reporting period:

E. H. Lathram, Co-Investigator, presented an invited paper "EROS Program, ERTS Satellites and Arctic Applications" at the Fifth International Congress of the Fondation Francaise d'Etudes Nordique, in Le Havre, France, May 2-5, 1973. One hundred and seventy-seven invited representatives of private industry, academia, governmental bodies and native organizations from the United States, France, England, Canada, Germany, Italy, Japan, Norway, Sweden, Denmark, Greenland, Belgium, Scotland, The Netherlands, and Finland were present. The theme of the Congress was "Arctic Oil and Gas: Problems and Possibilities". The paper addressed not only geological but other aspects of Arctic exploration and development, and discussed known and potential benefits to be derived from the use of ERTS data. Examples from this investigation and others were used in the paper.

The Principal Investigator, George Gryc, also presented an invited paper to the Congress, "The Analysis of Impact of Oil and Gas Pipeline Systems on the Alaskan Arctic Environment", which dealt with many of the problems whose solution will be facilitated by application of ERTS data.

Subsequent to the Congress Lathram visited ERTS Investigators, A. Fontanel and M. Guy, at the Institute Francaise du Petrole, Paris, France. Techniques and results of their studies of the structure and tectonics of the Alps and our similar study of Alaska were discussed and compared. It is notable that one of the principal results of their study is the recognition of probable crustal structures not heretofore recognized, a result similar to that reached in the study of Nimbus and ERTS images of Alaska, and discussed in previous progress reports of this investigation. Preliminary results of their coastal and marine studies and those of U.S. Geological Survey ERTS Investigators studying the Pacific coast of the U.S. were also compared.

Lathram also visited Gian Lupo del Bono, Servizio Geologico d'Italia, Rome, Italy, ERTS-1 and Skylab Co-Investigator with Paul Carlson, U.S. Geological Survey, and discussed progress of the joint investigations which include ERTS and Skylab data study, aircraft underflights by Italian Air Force planes, coastal sedimentation studies, sub-sea mapping by scuba diving, and sub-bottom acoustical profiling, all in the vicinity of Elba Island. This is an impressive and comprehensive investigation (Skylab-EREP Task No. 618).

In Madrid, Lathram conferred with personnel of ADARO and the Instituto Geologico y Minero, both federal government organizations. The application of ERTS data in mineral resource exploration with examples from Alaska and elsewhere was discussed. By invitation, Lathram gave a lecture on the application of ERTS data to general resource and environmental inventory and management, attended by private industry, academic and governmental personnel of various disciplines. Examples were drawn from the Alaskan as well as other ERTS and EROS investigations to illustrate the lecture.

"Concealed structures in Arctic Alaska identified on ERTS-1 imagery" by W. A. Fischer and E. H. Lathram, the in-depth study of the relation of linears first seen on image 1004-21395 to geologic and geophysical data available in the area, and the possible significance of the interpretation to petroleum exploration, was published in Oil and Gas Journal on May 28, 1973.

I. L. Tailleur continued the compilation of known geology on 1:250,000-scale enlargements of ERTS images of the western De Long Mountains, previously reported, and continued the interpretation of these images, extrapolating known geology onto unmapped areas with the ultimate aim of completing geologic maps using the ERTS images as orthophoto map bases.

E. H. Lathram prepared an exhibit showing the application of ERTS imagery to "Petroleum Exploration in Hostile Environments" for the national meeting of the American Association of Petroleum Geologists at Anaheim, California, in early May. The interpretation of

the linears seen on image 1004-21395 (Umiat, Alaska, area) was stressed. The exhibit also included a comparison of an ERTS image of Oman (1091-06074) and published geologic maps, showing that interpretation of the image could immediately improve the geologic maps; a comparison of an image of the Amazon jungle (1008-13481) and planimetric maps showing map errors and changes in drainage since the map was made; and a representation of the effectiveness of ERTS imagery (Image 1005-18171) in depicting the distribution and nature of ice in the Arctic ice-pack.

Geologists of the Alaskan Geology Branch, U.S. Geological Survey, participating in the investigation, have acquired 1:250,000-scale enlargements of numerous ERTS images to be used for mapping in the field as well as for checking new geologic interpretations resulting from study of ERTS imagery.

2. Accomplishments planned for the next reporting period:

G. Plafker and R. L. Detterman will use ERTS images in field study of the present state and history of movement of the major faults of southern Alaska as a part of the U.S. Geological Survey's program of earthquake research.

ERTS images will be used by H. Reiser as an adjunct to his field mapping in the northeastern Brooks Range and by I. L. Tailleur and W. P. Brosgé in mapping in the southwestern Brooks Range. Tailleur hopes to include in his fieldwork a ground check of the new interpretation of the structure in the Corwin area that resulted from his compilation of geology on ERTS images, as reported in the previous progress report.

W. W. Patton, Jr., is including in his fieldwork a ground check of the fracture pattern in the Alatna Hills first noted on ERTS image 1072-21180, and discussed in an earlier progress report and in the paper, "Preliminary Geologic Application of ERTS-1 Imagery in Alaska", presented at the ERTS Symposium in March.

R. L. Detterman, in the course of other fieldwork, will groundcheck the area of the Umiat image (1004-21395). He will be accompanied by John Koranda, Lawrence Radiation Laboratory, who is a member of the Tundra Biome Group under CRREL auspices. The purpose of this study is to determine the state of disturbances to the tundra caused by the extensive exploration that occurred in the area in the 1945-1952 period. W. A. Fischer pointed out, at the ERTS Symposium, that if the disturbances had spread "like cancer" as some purport, they should be visible on the ERTS image, but are not. It is important to determine the changes these scars have undergone in the intervening 20-year period. Ground measurements will be made, and color and color infrared photographs taken. These data will be related to the geologic and biologic environment in which the scars occur and to the historical record of their original condition.

e. Discussion of significant scientific results and their relationship to practical applications or operational problems including estimates of the cost benefits of any significant results:

On image 1043-20163 E. M. MacKevett, Jr., noted the regional extension of a fault mapped locally in the McCarthy area; study of vertical aerial photos and limited field data indicate it is the trace of a regionally significant tectonic feature of southern Alaska. (See abstract attached).

Category 4K

f. A listing of published articles, and/or papers, preprints, in-house reports, abstracts of talks, that were released during the reporting period:

Lathram, E. H., and Gryc, George, 1973, Metallogenic significance of Alaskan geostructures seen from space: Proceedings, Eighth Internat. Symposium on Remote Sensing of Environment, Ann Arbor, Mich., p. 1209-1211.

Fischer, W. A., and Lathram, E. H., 1973, Concealed structures in Arctic Alaska identified on ERTS-1 imagery: Oil and Gas Journal, v. 71, p. 97-102.

Lathram, E. H., (in press), EROS program, ERTS satellites, and Arctic applications: Proceedings, Fifth Internat. Symposium, Fondation Francaise d'Etudes Nordique, Le Havre, France, May, 1973.

g. Recommendation concerning practical changes in operations, additional investigative effort, correlation of effort and/or results as related to a maximum utilization of the ERTS system.

Discussions with private individuals, county and state land-use and resource planners and managers, and investigators, both in the U.S. and in Europe has revealed not only an intense interest in and need for ERTS-1 data, but also a strong requirement for continuance, i.e., launch and maintenance of ERTS-B or an operational satellite before, or at least as soon as the demise of ERTS-1. Particularly in Europe, the public awareness of the ERTS satellite was striking.

A recommendation of change in Principal Investigator on this investigation from George Gryc to Ernest H. Lathram has been made.

h. A listing of data of any changes in standing Order Forms:

None during reporting period.

i. ERTS Image Descriptor Forms:

None.

j. Listing by date of any changed Data Request Forms submitted to Goddard Space Flight Center/NDPF during the reporting period:

None.

k. Status of Data Collection Platforms (if applicable):

Not applicable.

Identification of Geostructures of Continental Crust Particularly As They Relate to Mineral Resource Evaluation

by

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The southeastward continuation of a fault that has been mapped in the vicinity of Dan Creek (McCarthy B-4 and B-5 quadrangles, Alaska) shows up as a lineament on ERTS image 1043-20163 that can be traced for more than 50 miles southeastward to beyond the Alaska-Canada boundary. The lineament probably reflects a major fault that is significant in understanding the complicated tectonics of the Wrangell Mountains-Saint Elias Mountains complex. From a study of the ERTS image, low-level vertical photography, and limited fieldwork in the largely unmapped region, E. M. MacKevett, Jr., speculates that the eastern part of the fault may mark the southern boundary of a mid-Paleozoic metamorphic terrane that constitutes the westernmost known extent of the Alexander terrane of Berg, Jones and Richter (1972) and correlates with the Kaskawulsh Group in Canada. This terrane, which consists dominantly of marble, was recognized during 1972 reconnaissance mapping in the east-central part of the McCarthy quadrangle by MacKevett, D. L. Jones, and D. H. Richter and contrasts strongly with the dominantly volcanic and volcanoclastic terrane of Pennsylvanian and Permian age that forms the basement in most of the McCarthy quadrangle.

Reference

Berg, H. C., Jones, D. L., and Richter, D. H., 1972, Gravina-Nutzotin belt-tectonic significance of an upper Mesozoic sedimentary and volcanic sequence in southern and southeastern Alaska, in Geological Survey Research 1972: U.S. Geol. Survey Prof. Paper 800-D, p. D1-D24.